

NEW RECORDS OF FLEAS (SIPHONAPTERA) FROM EASTERN WEST VIRGINIA

RALPH P. ECKERLIN AND HARRY F. PAINTER

Natural Sciences Division, Northern Virginia Community College, Annandale, VA
22003 U.S.A. (e-mail: reckerlin@nv.cc.va.us)

Abstract.—Nine species of fleas are reported for the first time from the boreal environment in the mountains of eastern West Virginia. The new state records are *Ceratophyllus gallinae* (Schrank), *Conorhinopsylla stanfordi* Stewart, *Epitedia faceta* (Rothschild), *Hystrihopsylla tahavuaana* Jordan, *Megabothris asio asio* (Baker), *M. quirini* (Rothschild), *Nearctopsylla genalis genalis* (Baker), *Rhadinopsylla media* Smit, and *Tamphilola grandis* (Rothschild).

Key Words: Appalachian Mountains, fleas, distribution, West Virginia

We report nine flea species found in the higher elevations of the Appalachian Mountains of West Virginia along the eastern border with Virginia where boreal conditions are found. There has been considerable study of the biota of the Appalachian balds (Mark 1958) and spruce and northern hardwood forests (Handley 1971, Stephenson and Adams 1984, and references therein) demonstrating plants and animals characteristic of the boreal environments of more northern regions. Results of these studies suggested to us that fleas common to more northern environments might be present in West Virginia because of the presence of appropriate mammal hosts and the existence of boreal conditions suitable for their non-parasitic larval stages. Benton (1971, 1980) added seven new species to the West Virginia list bringing the state total to 24 and further noted that an additional 20 fleas not then known from the state should be present. We add nine new flea species to the West Virginia list with all but one expected by Benton.

MATERIALS AND METHODS

Collections were made in the eastern mountains of the Ridge and Valley Province of West Virginia as often as could be arranged during all months of the year from 1984 to 1996. Bird and mammal nests were placed in a Berlese funnel overnight in the laboratory to extract fleas. Small mammals were trapped using Sherman live traps and snap traps. Live animals were placed in paper bags containing paradichloro-benzene crystals for a few minutes and then released into plastic bags for identification, sexing and a check for fleas still in the pelage. The animals were then released in the vicinity of their capture. Collection data were written on the paper bag and the contents were examined for fleas in the laboratory. Mammals found dead were brushed over a white enameled pan and fleas were placed in ethanol. Five nest boxes were placed about 3 m high in a stand of red spruce (*Picea rubens* Sargent) on Alleghany Mountain in Pocahontas County at an elevation of 1,300 m to monitor the fleas of flying squirrels.

White polyester fiber was provided as nesting material and sampled as nearly monthly as weather would permit for a year. Sampling involved removal of only half of the fiber from a nest box, placing it in a plastic bag and replacing it with fresh fiber, thereby permitting the maintenance of succeeding generations of parasites. Fleas were removed from the retained nesting material in the lab and stored in ethanol. All fleas were decolorized in 10% KOH, dehydrated in ethanol, cleared in xylene and mounted in Canada balsam. Fleas were identified using keys developed by Benton (1983) and Holland (1985). Mammal names follow Wilson and Reeder (1993).

RESULTS

The following nine flea species new to the state of West Virginia were collected.

Ceratophyllidae

Ceratophyllus gallinae (Schrank)

3 ♀ from the nest of *Sialia sialis* (L.), 26 Sept 1993, Pocahontas County, Top of Allegheny.

This European hen flea is a wide-ranging species from Alaska and Canada (Holland 1985) as well as northeastern United States (Benton 1980). Domestic chickens and native birds are the usual hosts. This is the southernmost reported occurrence of this species in the eastern United States.

Megabothris quirini (Rothschild)

1 ♀ ex *Clethrionomys gapperi* (Vigors), 15 Nov 1984, 1 ♀ ex *C. gapperi*, 20 April 1985, 1 ♀ ex *Microtus pennsylvanicus* 26 Sept 1993, all from Pocahontas County, Alleghany Mountain. 1 ♂, 2 ♀ ex *C. gapperi* 30 June 1985, 1 ♀ ex *Peromyscus leucopus* (Rafinesque), 30 June 1985, Randolph County, Spruce Knob Lake. 4 ♀ ex *C. gapperi*, 29 Aug 1985, 1 ♂ ex *M. chrotorrhinus* (Miller), 9 Dec 1985, 3 ♀ ex *C. gapperi* 18 May 1986, all from Pendleton County, Spruce Knob.

Hopla (1965) stated that *M. quirini* "is a flea that has migrated into the boreal re-

gions from the south following the retreat of the Pleistocene glaciers." It is found on mice in seven genera (Holland 1985). Our collections were primarily from microtines. Five of 72 *C. gapperi*, 1 of 9 *M. chrotorrhinus* and 1 of 27 *P. leucopus* were infested. In the eastern United States this flea had been reported only from New York and New England (Benton 1980). The nearest record to those reported here is from southern New York, over 500 km to the northeast.

Megabothris asio asio (Baker)

1 ♂, 26 ♀ ex 9 *Microtus pennsylvanicus* and 1 ♂ ex *Peromyscus maniculatus* (Wagner), 18 Nov 1984; Pocahontas County, Alleghany Mountain; 2 ♀ ex 2 *M. pennsylvanicus*, 1 ♂ ex *P. maniculatus* and 1 ♂ ex *C. gapperi*, 20 Oct 1985 from Tucker County, Dolly Sods; 1 ♂ ex *M. chrotorrhinus*, 9 Dec 1985 Pendleton County, Spruce Knob; 1 ♂, 4 ♀ ex *M. pennsylvanicus* 30 Jun 1985, Randolph County, Spruce Knob Lake.

Numerous collections were made at these four sites during the Fall, Winter and Spring months. This is another flea found primarily on microtine hosts with a boreal distribution in eastern Canada and northeastern United States. The previous nearest record of this flea is in Pennsylvania. Thus, our Appalachian records from West Virginia extend the range about 300 km to the south.

Ctenophthalmidae

Conorhinopsylla stanfordi Stewart

1 ♂, 1 ♀ ex *Glaucomys volans* (L.) nest, 10 Nov. 1985, Pocahontas County, Alleghany Mountain.

This flea is blind and is primarily a nest flea on flying squirrels. Other hosts include squirrels in the genera *Sciurus* and *Tamiasciurus* (Holland 1985). It is known from Ontario to Maryland so this is the southernmost occurrence in the East. This flea is not plentiful in collections, probably due to a dearth of nest examinations of the flying squirrel in winter. It was found in larger

numbers in more extensive nestbox arrays in neighboring Virginia.

Tamiophila grandis (Rothschild)

2 ♀ ex *Tamias striatus* (L.), 25 Sep 1993, 12 Oct 1996, Pocahontas County, Top of Allegheny.

As the name implies, this is a large flea and a parasite of the chipmunk, of which 2 of 15 were parasitized. This flea is rare in collections because it is a nest flea and is rarely taken on the host. It occurs from Ontario to southwestern Virginia where it was recently reported by Eckerlin and Painter (1995).

Eptedia faceta (Rothschild)

2 ♀ from nest of *G. volans*, 19 Jan 1986, Pocahontas County, Alleghany Mountain.

This nest flea is most abundant in the late fall and early winter (Benton 1980). Both northern and southern flying squirrels are hosts but the flea is restricted to eastern Canada and eastern United States, corresponding closely with the range of *G. volans* (Holland 1985). The southernmost reported occurrence of *E. faceta* is eastern Tennessee in the Appalachians at high elevation (Durden and Kollars 1997).

Nearctopsylla genalis genalis (Baker)

3 ♀ ex *B. brevicauda*, 9 Dec 1985, Pendleton County, Spruce Knob; 1 ♀ ex *B. brevicauda*, 3 Nov 1995, Pocahontas County, Alleghany Mountain, 4 ♀ ex *Sorex fumeus* Miller, 18 Nov 1984, Pocahontas County, Top of Allegheny.

Benton (1980) refers to this flea as a fall and winter flea and indeed our records are all in the fall months. With a range from Ontario and Illinois eastward to the Atlantic seaboard states, *N. genalis* was previously collected no further south than Pennsylvania. The Pocahontas County site extends the range of this species 300 km southward at high elevations in the Appalachians. Two of 33 *B. brevicauda* and 1 of 2 *S. fumeus* were infested.

Rhadinopsylla media Smit

1 ♀ from nest of *Neotoma floridana* (Ord), 17 Sep 1950, Pendleton County, Franklin, collected by Price and Tipton.

The single damaged specimen is deposited in the Monte L. Bean Life Sciences Museum at Brigham Young University and was kindly loaned us by Michael Hastriter.

Hystrichopsyllidae

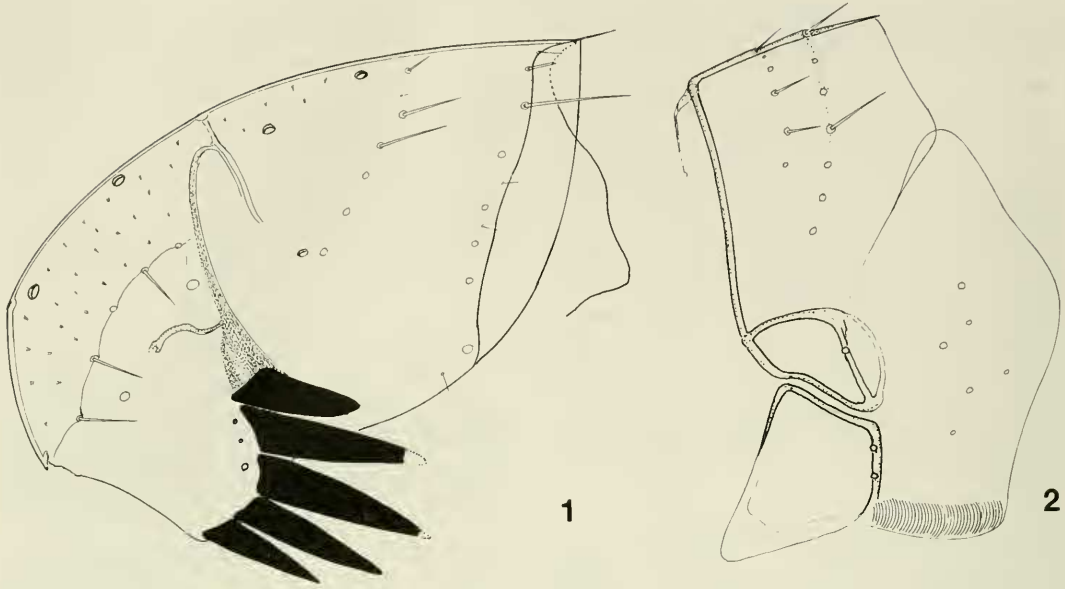
Hystrichopsylla tahavauana Jordan

1 ♀ ex *Blarina brevicauda* (Say), 18 May 1986, Randolph County, Spruce Knob Lake, and 1 ♀ from nest of *Microtus pennsylvanicus* (Ord), 25 Oct 1986, Pocahontas County, Top of Allegheny.

This large flea was described from the two host species we list. Scattered records exist from Ontario to Tennessee. Only 1 of 33 *B. brevicauda* was infested so we regard this as an uncommon flea.

DISCUSSION

Eight of the nine new records are species Benton (1971) predicted would be found in West Virginia. The only unexpected species was *Rhadinopsylla media* whose nearest reported occurrence is in Michigan and Minnesota (Benton and Timm 1976). Additional comment is warranted by the considerably greater physical separation between this record and other specimens of this seldom collected flea. Pfitzer (1950), in his unpublished master's degree thesis reported collecting a number of the closely related *Rhadinopsylla orama* Smit 1957 from Wise County, Virginia just north of the Tennessee/Virginia line. The number and location of genal spines (of the *R. media* specimen, Fig. 1) confirm placement of the West Virginia specimen in *Rhadinopsylla* and the long suture between the metanotum and metepimeron (Fig. 2) separates *R. media* from the only other eastern species, *R. orama*, which is found in the adjacent states of Virginia, Pennsylvania, and Maryland (Benton 1980), but was not observed in this study. We agree with Benton and Timm



Figs. 1-2. *Rhadinopsylla media*. 1, Head. 2, Metathorax showing suture between metanotum and metepimeron.

(1976) that more specimens are required to determine distribution of these poorly known fleas.

Epitedia faceta, *Hystrichopsylla tahaviana*, *Megabothris a. asio*, *M. quirini*, *Nearctopsylla g. genalis* and *Tamiophila grandis* have extensive distributions north of West Virginia, but are restricted to high elevations southward in the Appalachian mountains. We regard these species and their environments in West Virginia as boreal. Significant extensions of ranges were demonstrated for *N. g. genalis* and *M. a. asio*, previously not collected south of Pennsylvania and *M. quirini*, not collected south of New York. Conversely, *Conorhinopsylla stanfordi* and *Ceratophyllus gallinae* are widespread and not ecologically bound to the Appalachians. *Conorhinopsylla stanfordi* adults in the nests of flying squirrels have a pronounced cold weather peak of abundance and are absent for most of the year (Benton and Day 1980). Many species of birds serve as hosts of *C. gallinae* including many cavity nesters such as bluebirds (Holland 1985) which are found throughout the study area. The total number

of species reported from West Virginia now stands at 33. We believe that more of Benton's (1971) hypothesized species will be discovered in West Virginia with additional collecting.

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